of the light emerges into the film of water, and is then absorbed by the black paper.

Fig. C represents a photograph taken upon a yellow glass plate, with a backing of wet black paper, but otherwise exposed under similar conditions to the photograph represented in Fig. B.

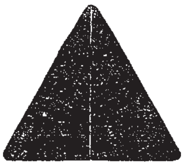

FIG. C

The outer irradiation halo may therefore be entirely avoided for the future in any corona or other necessarily over-exposed photographs by the use of the opaque plates. If, however, it is considered important that the negatives should be capable of being copied by transmitted light, the outer halo may still be to a great extent avoided by the use of transparent glass plates with a backing of wet black paper or black varnish.

Secondly, as to the inner and more definitely-marked irradiation edge which remained and seemed to be unaffected by the precautions that had served to rid us of the outer halo. Since the inner fringe was equally to be found on an opaque and on a transparent plate, we felt ourselves justified in seeking for its cause in front of the first or upper surface of the prepared plate; that is, it must be referred either to some action taking place within the thickness of the collodion, or to the optical imperfections of the instrument.

In order to determine whether the scene of action lay within the thickness of the collodion, we placed an ivory ruler with a bevelled edge in immediate contact with the collodion film. The plate with the ruler upon it was then exposed within the camera, so that the image of an incandescent platinum wire fell partly upon the collodion film, and partly upon the ivory ruler. If the scene of action lay within the collodion film, we might expect the inner irradiation fringe to extend itself under the edge of the ruler, while if it were due to the optical imperfections of the lens, the image of the wire would be cut off sharply by the edge of the ruler.

On removing the plate from the camera, and before the ruler was shifted from its place on the collodion, the whole was exposed for a few seconds to the action of the light from a gas-burner, in order that the position occupied by the edge of the ruler might be faintly printed upon the collodion film. On developing the plate, it was found that the image of the wire was sharply cut off at the place occupied by the edge of the ruler, as in Fig. D.

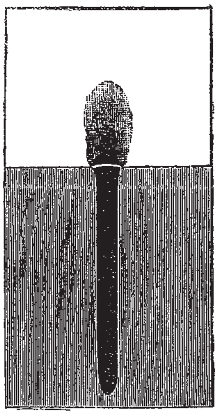

FIG. D

The very faint action extending inwards under the ruler being evidently due to the want of perfect opacity in the ivory, it seems, therefore, to be clearly proved that the inner irradiation edge is not caused by any chemical or other action taking place within the thickness of the collodion; but must be referred to the optical imperfections of the instrument which throws the image upon the collodion film.

It is instructive to remark that the photographic image of the wire is not cut off by an absolutely straight line at the edge of the ruler, but it is slightly convex, and is separated from the faint action which has apparently taken place through the ruler by a very narrow bright line, which appears to indicate the presence of a small capillary film of liquid along the edges of the ruler, forming a minute cylindrical lens. At the point where the collodion was acted upon by the light, the minute cylindrical lens appears to have been interfered with, and depressed inwards towards the ruler; we may therefore conclude that the collodion film is slightly swelled or thickened by the action of the light upon it.[*]

The cause of the inner irradiation-edge seems to be that every point of a luminous object is not represented by a simple point of light in the luminous image; in other words, the circle of least diffusion of any pencil is a curve of sensible area, of which the central and most intense portions imprint themselves first upon the collodion.

Some further experiments were made in order to test whether the size of the circles of least diffusion was chiefly owing to chromatic aberration (in which case the difficulty might be got rid of by the use of reflectors); for this purpose a bath of solution of sulphate of copper was placed in front of a gas-burner, and the triangular diaphragm shown in Fig. A was then placed between the sulphate of copper bath and the lens of the camera; but the blue screen thus formed seemed to have very little effect in altering the breadth of the irradiation-fringe, only slightly retarding the rate of its formation; a similar result was obtained on placing a piece of yellow glass in front of the diaphragm; in this case, however, the formation of the fringe was still further retarded.

Photographers have long known that by making use of stops they can obtain a much sharper image. By way of experiment, we cut off the edges of the lens with a circular stop, and found that the inner irradiation-fringe was thus greatly decreased. It seems, therefore, fair to argue that the aberration of oblique pencils exceeds in magnitude the other disturbing causes, and that it will be well, in making preparations for the photographic observation of the transit of Venus, to avoid as much as possible all oblique pencils.

We would, therefore, place our photographic plates in the primary focus, and thus avoid the necessarily deep curves of any arrangement of lenses which may be used for enlarging the image. Whether it would be best to make use of a reflector or a refractor, remains to be settled by further experiment, but our present experiences would lead us to vote in favour of the reflector.

We cannot conclude without returning our best thanks to Mr. H. Davis, who has rendered us able assistance in carrying out the foregoing experiments.

SCIENTIFIC SERIALS

Annalen der Chemie und Pharmacie, February and March 1872.—This double number is unusually bulky; it contains no less than 252 pages, and abounds with much interesting matter. The effect of the new management seems to be evident, as the last paper published in this number was only received on January 14; formerly some two or three months generally elapsed from the time of the reception of a paper before its publication. The number of the papers renders it impossible in the short space at our disposal to give more than a passing glance at some of the more important. Amongst them we notice three papers in continuation of Linnemann's researches; these treat of the synthesis of normal butyric acid, of butyl alcohol, and on some of the

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[*] We are at present unable to find any explanation of the slight apparent thickening of the end of the image of the wire where it abuts upon the ruler, but the same thickening is to be found in all the plates. It may be well to remark that it appears evident from slight indication in the negatives which it would be difficult to render in a woodcut, that the true edge of the ruler coincides with the inner side of the white line (or with the side away from the image of the wire). The convexity of the end of the image of the wire cannot, therefore, be regarded as indicating even a slight chemical encroachment. The slightly tapered appearance of the other end of the image of the wire is due to the fact that the platinum incandescent wire is cooled at its points of contact with the thick copper wires of the circuit.

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normal butyl derivatives. The author prepared the normal butyric acid from iodide of propyl, which he obtained from the products of fermentation. This was boiled with potassic cyanide, and the product treated with alcoholic potash, yielding potassic butyrate; from this it is easy by well-known methods to prepare the alcohol and its derivatives, many of which have been carefully studied and are described in these pages.—Gorup-Besanez contributes a paper on the ozone reactions in the neighbourhood of the evaporating houses of salt springs (Gradirhäusern); he finds that when large quantities of water evaporate spontaneously or in a current of air, ammonic nitrate and ozone are formed in appreciable quantities, and that the nearer to the evaporating surface the ozone paper was placed the more intense was the ozone reaction.—Schorlemmer has contributed a paper on the normal paraffines. He has examined many of them, such as pentan or amyl hydride, and hexan and heptyl hydride; he finds that by the action of chlorine on these pure bodies in each case two isomeric chlorides are obtained, and from which a primary and secondary alcohol can be produced, which yield a ketone and an acid by oxidation.—The next paper is by Patera "On the means of protecting textile fabrics, &c., from fire." The author's only objection to the use of tungstate of soda, which he considers very efficient, is on account of its price. He proposes as a substitute a mixture of four parts of borax and three parts of magnesic sulphate, which is freshly prepared and dissolved in 20 to 30 parts of warm water; the fabric to be protected is dipped in the solution, wrung out and dried. A second substitute is a mixture of ammonic sulphate and gypsum.' These mixtures can be used for such things as crape, tulle, muslin, canvas, wood, and rope.—Wartha has a short note on the action of potassic hydrate on anthraquinone. He finds that at high temperatures these two react and form small quantities of alizarin.—Sintenis contributes a long and interesting paper "On our knowledge of the benzyl ethers;" and Popoff another on the oxidation of the ketones, both of which deal very thoroughly with their respective subjects.

THE *American Journal of Science and Arts* for June opens with a paper on the early stages of the America Lobster (*Homarus americanus* Edw.) by Mr. S. J. Smith illustrated with a plate. Dr. J. J. Woodward contributes some Remarks on the nomenclature of Achromatic Objectives for the Compound Microscope, and Prof. A. M. Mayer a description of a new form of Lantern-Galvanometer. Mr. S. W. Ford describes some new species of Primordial Fossils, and Mr. F. B. Meek some new fossils from the Cincinnati Group of Ohio; and a further important contribution to palæontological science is found in Prof. O. C. March's paper on the Structure of the Skull and Limbs in Mosasauroid Reptiles, with descriptions of new genera and species, illustrated by four plates. The new genera described are *Lestosaurus*, four species, and *Rhinosaurus*, one species. The continued articles from preceding Nos. are Prof. Verrill on Radiata from the Coast of N. Carolina, and Prof. Norton on Molecular and Cosmical Physics.

THE *Scottish Naturalist* for July consists mainly of short notes of observations and discoveries relating to Scottish Natural History, chiefly Zoology. We find also the following articles of somewhat greater length:—Description of a new Hemipter, *Anthomyia Sonchi* (the sow-thistle fly), by Mr. Jas. Hardy; on the Nest of *Formica rufa* and its inhabitants, by Dr. Buchanan White; Notes on Scottish Hemiptera, also by the Editor; On the "Yellow Fins" of the Allan-water, by Dr. W. C. M'Intosh, and the continuation of the Lists of Scottish Lepidoptera and Coleoptera by Drs. Buchanan White and Sharp.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 20.—"On the present amount of Westerly Magnetic Declination (Variation of the Compass) on the Coasts of Great Britain, and its Annual Changes." By Staff-Captain Frederick J. Evans, R.N., F.R.S.

The rapidly accelerating value within the last few years of the westerly magnetic declination over the whole area of the United Kingdom and the adjacent seas, as observed at the fixed magnetic observatories of Greenwich, Kew, Brussels, Paris, and also at Christiana in Norway, is a subject of importance in practical navigation as affecting the compass bearings derived from charts and those laid down for the guidance of pilots.

The attention of the Hydrographic Department of the Admiralty has been constantly directed to this interesting physical fact; and as the duties of Her Majesty's surveying vessels employed on our shores between the years 1866—1870 embraced nearly the whole extent of coast line, advantage was thus taken to determine, with great attention to accuracy, the magnetic declination at widely spread and favourable localities.

The observations thus made by the surveying officers of H.M. navy are given in detail, with the corrections for secular change, to Jan. 1, 1872,* for which epoch a chart of the British Islands, exhibiting the lines of magnetic declination of equal value, is also appended. By comparing these lines with the corresponding lines given in the Declination Chart for 1842·5, Phil. Trans. for 1870, art. xiv., "Contributions to Terrestrial Magnetism," No. xii., by General Sir Edward Sabine, the annual decrease of the westerly declination, in the interval 29·5 years, over various geographical districts is thus shown:—

Shetland Islands and N.E. coast of Scotland, between 56th and 60th parallels	8′·24
E. coast of England, between 56th and 51st parallels	7·78
S. coast of England, between 51st and 49th parallels	7·34
Dungeness to Scilly Islands, with the Channel Islands	
(Greenwich Observatory	7·14)
Irish Channel, between 52nd and 54th parallels	7·10
Hebrides and W. coast of Scotland, between 56th and 58th parallels	6·85
Ireland, S.W., W., and N.W. coast, between 52nd and 55th parallels	6·26

It is thus seen that in the area included by the shores of the United Kingdom, the change was greater on the eastern than on the western side; as also that in the higher parallels of latitude of this area the change was greater than in the lower parallels.

By a further comparison of results as observed within the last ten to twelve years, at the same stations within the same geographical districts, the following approximate values of the present rate of annual change (westerly declination, decreasing) are obtained:—

Shetland Islands and N.E. coast of Scotland...	11′·2
E. coast of England (Bridlington)	10·3
S. coast of England (Plymouth)...	7·9
Scotland, W. and N.W. coasts	9·5
Ireland, S.W. coast	6·6

These values are in satisfactory accordance with those obtained in the interval (1865–71) at the following fixed magnetic observatories:—

Greenwich ...	8′·33	mean annual decrease of westerly declination.
Kew... ...	8·08	" " "
Stonyhurst ...	7·85	" " "

"On the Physical Nature of the Coagulation of the Blood," by Alfred Hutchison Smee.

"On the Detection of Organic and other Nitrogenised Matter existing in the Atmosphere," by Alfred Hutchison Smee.

"Contributions to Terrestrial Magnetism, No. XIII.," by General Sir Edward Sabine, K.C.B., V.P.R.S.

The author presents this paper as the companion of No. XI. of his "Contributions to Terrestrial Magnetism," which contained the Magnetic Survey of the Southern Hemisphere from 40° S. lat. to the extreme limit towards the Southern Pole, as does the present memoir, No. XIII. of the same series, the three magnetic elements from 40° N. lat. to the furthest attained limit of the Northern Pole. In both papers the mean epoch is the same, viz., 1842·5. Where it has been possible to do so, corrections to this mean epoch have been obtained and applied to earlier and later observations.

The determinations are derived from observers of all countries, and are arranged in zones, each of 5° of lat., passing round the globe. The table thus formed contains between 3,000 and 4,000 stations at which the magnetic elements have been determined. The observers are named, and references are made to the sources from whence their observations are taken. The paper is accompanied by maps of the resulting Isogonic, Isoclinal, and Isodynamic Lines, executed at the Hydrographic Office.

"On the Law of Extraordinary Refraction in Iceland Spar," by G. G. Stokes, Sec. R.S.

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* A mean value of 19° 40′ being assumed for the westerly magnetic declination at Greenwich Observatory for this epoch.

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